



Migrate or evolve: Options for plant pathogens under climate change

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Abstract:

Findings on climate change influence on plant pathogens are often inconsistent and context dependent. Knowledge of pathogens affecting agricultural crops and natural plant communities remains fragmented along disciplinary lines. By broadening the perspective beyond agriculture, this review integrates cross-disciplinary knowledge to show that at scales relevant to climate change, accelerated evolution and changing geographic distribution will be the main implications for pathogens. New races may evolve rapidly under elevated temperature and CO₂, as evolutionary forces act on massive pathogen populations boosted by a combination of increased fecundity and infection cycles under favourable microclimate within enlarged canopy. Changing geographic distribution will bring together diverse lineages/genotypes that do not share common ecological niche, potentially increasing pathogen diversity. However, the uncertainty of model predictions and a lack of synthesis of fragmented knowledge remain as major deficiencies in knowledge. The review contends that the failure to consider scale and human intervention through new technology are major sources of uncertainty. Recognizing that improved biophysical models alone will not reduce uncertainty, it proposes a generic framework to increase focus and outlines ways to integrate biophysical elements and technology change with human intervention scenarios to minimize uncertainty. To synthesize knowledge of pathogen biology and life history, the review borrows the concept of 'fitness' from population biology as a comprehensive measure of pathogen strengths and vulnerabilities, and explores the implications of pathogen mode of nutrition to fitness and its interactions with plants suffering chronic abiotic stress under climate change. Current and future disease management options can then be judged for their ability to impair pathogenic and saprophytic fitness. The review pinpoints improving confidence in model prediction by minimizing uncertainty, developing management strategies to reduce overall pathogen fitness, and finding new sources of data to trawl for climate signatures on pathogens as important challenges for future research.

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Resource Description

Exposure :

weather or climate related pathway by which climate change affects health

Ecosystem Changes, Food/Water Security, Temperature, Unspecified Exposure

Food/Water Security: Agricultural Productivity

Temperature: Fluctuations

Climate Change and Human Health Literature Portal

Geographic Feature:

resource focuses on specific type of geography

None or Unspecified

Geographic Location:

resource focuses on specific location

Global or Unspecified

Health Impact:

specification of health effect or disease related to climate change exposure

Health Outcome Unspecified

Mitigation/Adaptation:

mitigation or adaptation strategy is a focus of resource

Adaptation

Model/Methodology:

type of model used or methodology development is a focus of resource

Exposure Change Prediction, Methodology

Resource Type:

format or standard characteristic of resource

Review

Timescale:

time period studied

Time Scale Unspecified